

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.: 09/574,697  
Applicants: Chau, Paul  
Filed: 05/17/2000  
Title: Integrated Circuit Card Interface  
Device with Multiple Modes of Operation  
Art Unit: 2194  
Examiner: Nguyen, Van  
  
Atty. Docket No.: 18526  
Customer No.: 23676

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**DECLARATION UNDER 37 C.F.R. § 1.131**

I, Paul Chau, declare that:

1. I am a co-inventor of the subject matter claimed in the above-identified non-provisional patent application (U.S. Serial No. 09/574,697).
2. I understand that the application includes the following claims:

Claim 2

The integrated circuit card interface device of claim 43, wherein said application memory further comprises a read-only memory.

Claim 3

The integrated circuit card interface device of claim 43, wherein said application memory further comprises an electrically erasable programmable read-only memory.

Claim 4

The integrated circuit card interface device of claim 43, wherein said application engine further comprises a microcontroller.

Claim 5

The integrated circuit card interface device of claim 4, wherein said microcontroller further comprises said application memory.

Claim 6

The integrated circuit card interface device of claim 43, wherein said input/output module comprises a microcontroller.

Claim 7

The integrated circuit card interface device of claim 43, wherein said application engine further comprises a custom circuit.

Claim 8

The integrated circuit card interface device of claim 7, wherein said custom circuit further comprises said application memory.

Claim 9

The integrated circuit card interface device of claim 43, wherein said input/output module further comprises a custom circuit.

Claim 41

The integrated circuit card interface device of claim 43, wherein the interface device is portable.

Claim 43

An integrated circuit card interface device comprising:

an application memory;

an application engine for managing one or more applications in said application memory;

an input/output module;

a host interface;

one or more integrated circuit card interfaces; and

an internal power supply;

wherein the interface device is adapted to enable operation in accordance with multiple modes of operation comprising

a standalone mode of operation in which the interface device is not operably connected to any host device via the host interface, and

a reprogramming mode of operation, in which the interface device is operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces, and/or to a host device via the host interface, to enable one or more programs to be added to, modified in, or deleted from, the interface device.

Claim 44

The integrated circuit card interface device of claim 43, wherein the standalone mode of operation comprises a mode of operation in which the interface device is operably connected to an integrated circuit card via one of the

one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 45

The integrated circuit card interface device of claim 44, wherein the standalone mode of operation further comprises a mode of operation in which the interface device is not operably connected to another device to enable communication therebetween.

Claim 46

The integrated circuit card interface device of claim 45, wherein the multiple modes of operation further comprise a connected mode of operation in which the interface device is operably connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 47

The integrated circuit card interface device of claim 46, wherein during the connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 48

The integrated circuit card interface device of claim 44, wherein the multiple modes of operation further comprise a mode of operation in which the interface device is operably connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 49

The integrated circuit card interface device of claim 43, wherein during the

connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 50

The integrated circuit card interface device of claim 43, wherein the standalone mode of operation comprises a mode of operation in which the interface device is not operably connected to another device to enable communication therebetween.

Claim 51

The integrated circuit card interface device of claim 50, where the multiple modes of operation further comprise a connected mode of operation in which the interface device is operably connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 52

The integrated circuit card interface device of claim 51, wherein during the connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 53

The integrated circuit card interface device of claim 43, wherein the multiple modes of operation further comprise a connected mode of operation in which the interface device is operable connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 54

The integrated circuit card interface device of claim 53, wherein during the connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 68

The integrated circuit card interface device of claim 43, further comprising:

a display unit; and

an input unit.

Claim 69

A portable integrated circuit card interface device, comprising:

an application memory;

an application engine for managing one or more applications in said application memory;

an input/output module;

a host interface;

one or more integrated circuit card interfaces;

means for operation without external power;

means for a standalone mode of operation in which the interface device is not operably connected to a host device via the host interface, and

means for a reprogramming mode of operation for adding, modifying, or deleting programs from the interface device.

Claim 78

The integrated circuit card interface device of claim 43, wherein the one or more programs are subject to security verification.

Claim 79

The integrated circuit card interface device of claim 43, wherein the interface device is operable while being carried by a user.


3. Prior to February 1, 1999, my coinventors and I conceived the present invention in the United States.
4. Prior to February 1, 1999, I documented the principal features of the present invention in a laboratory notebook, two pages of which are shown in Exhibit A. Exhibit A has been redacted to remove the date shown thereon. This date, however, precedes February 1, 1999.
5. Exhibit B comprises several Spyrus Invention Idea Forms which my coinventors Gerry Vandenengel and Kerry Mathew, and I, completed prior to February 1, 1999, and which disclose the present invention, including all of the limitations of claims 2-9, 41, 43-54, 68, 69, 78, and 79. Exhibit B has been redacted to remove all dates shown thereon. All such dates, however, precede February 1, 1999. Exhibit B has also been redacted to remove certain parts not necessary for purposes of this declaration.
6. Exhibit C comprises two schematic diagrams, illustrating a circuit from which a prototype, the Development Platform, was constructed. The Development Platform comprised two printed circuit boards. Exhibit C has been redacted to remove all dates shown thereon. All such dates, however, precede February 1, 1999.
7. Prior to February 1, 1999, I used the Development Platform in the United States to demonstrate the feasibility and function of the present invention, including all of

the limitations of claims 2-9, 41, 43-54, 68, 69, 78, and 79. .

I hereby declare that all statements made herein of my own knowledge are true and that the statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the U.S. Code and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

Date:

March 03, 2009

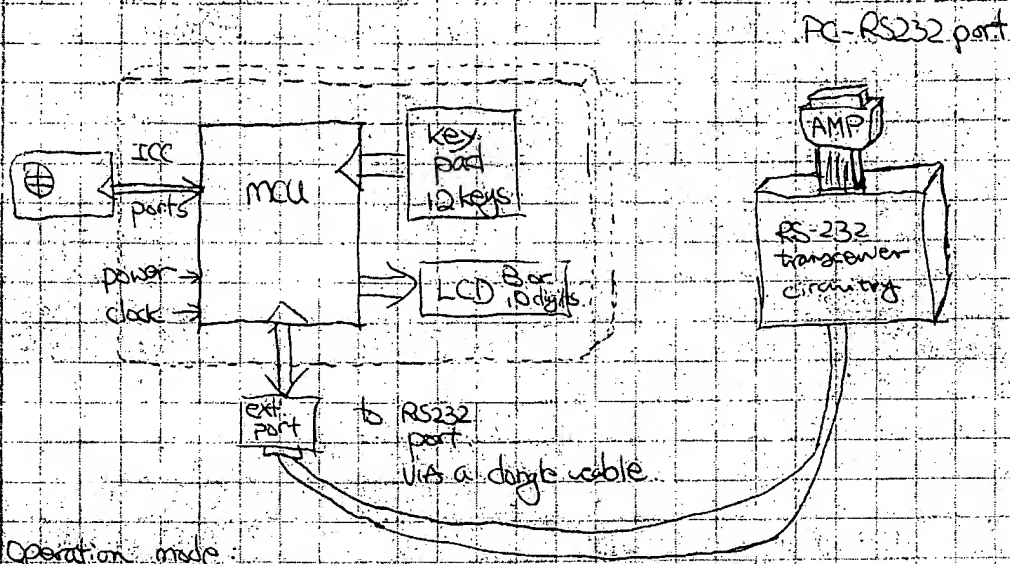


Paul Chau



## Exhibit A

## Design block Diagram



## Operation mode

### ① Standalone / passive mode

External port and the keypad data entry module are not active. The unit is used to provide static (pre-defined) data from the card e.g. balance of purse. This mode is active when the power-on button is pressed, then the unit will provide the continuous display of information on the LCD until it reaches the end of the display sequence. At the end of display, if no key is pressed the unit will time itself out in 2 seconds.

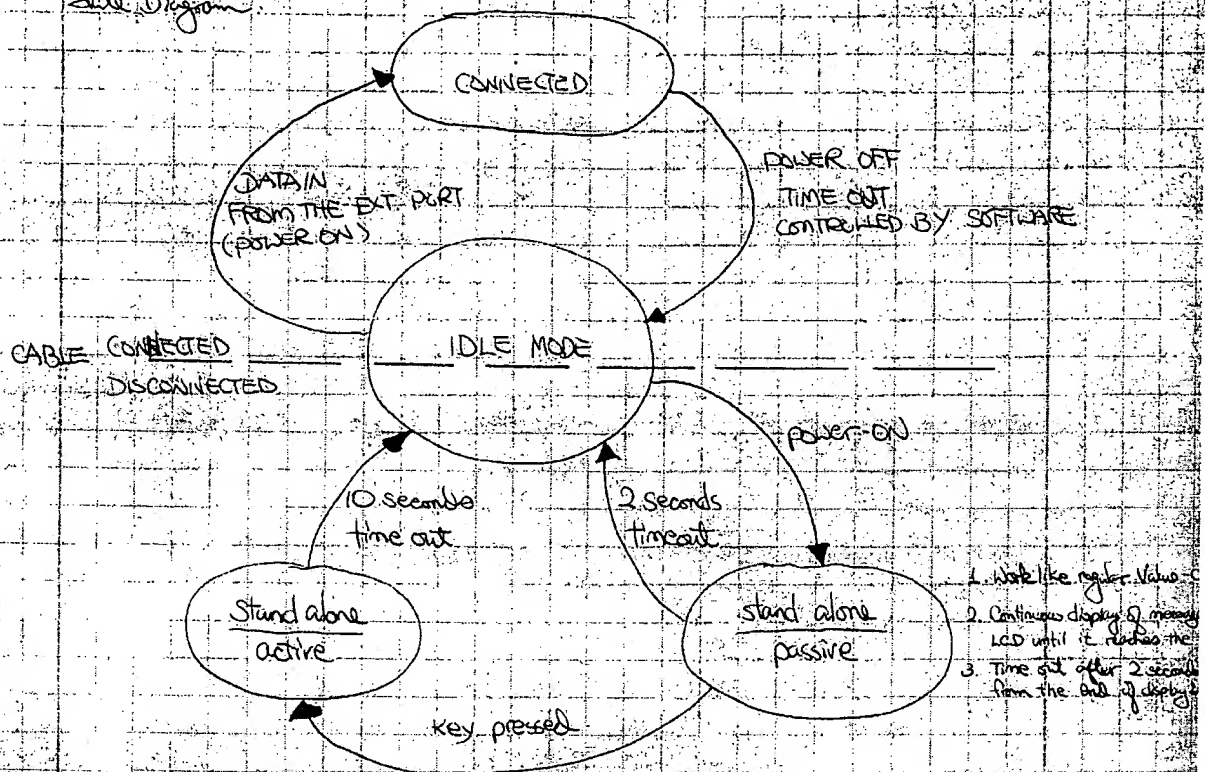
### ② Standalone / active mode

External port is not active. Upon power on, user can interrupt the display routine sequence of the static data by pressing another key on the keypad. Once the unit is in the active mode, the LCD will display message to instruct user to enter data. At anytime when no keypad activities happened, the unit will time out in 10 seconds.

### ③ Connected mode

~~When~~ When the unit is connected to the PC through the special cable, it will stay at the connected mode. At this point, instruction and data will be coming in and out through the external port. And also the power might be supplied by the external source as well. Therefore, the unit's power will be controlled by the PC. Any time out routine will be handled by the software.

## State Diagram



## Application

## ① Standalone/passive mode

- predefined data/info display of the IC card
- command and procedure needed to be masked into the MCU
- self start routine upon power on

## ② Standalone/active mode

- selective display of IC card data, eg. to display the 4<sup>th</sup> latest payment res
- IC card locking and unlocking through pin entry presentation
- IC card data record update, external data can be transferred into the card
- optional validator function?

## ③ connected mode

- Complex applications designed at the high level can be translated into APDU command and sent through the RS232 path. Data response from the card will be returned through the same path
- eg. transform the unit/system to be as home banking machine through the PC

## Exhibit B

**SPYRUS INVENTION IDEA FORM**

Docket No. (to be assigned by SPYRUS legal):

PAT 37-01-4025

Name of person completing this form:

Paul Chau

Date this form was completed:

The purpose of this form is to provide a brief description of any ideas that you feel could lead to patentable inventions by SPYRUS. It should be filled out and filed with the Legal Office. Once completed, a determination will be made of whether to proceed with a full invention disclosure.

SPYRUS is committed to building a strong patent portfolio, both to protect our intellectual property rights and to strengthen our corporate position. Please document anything that you may be working on which you feel could be patented.

All of the following entries should be made in ink or type.

- I. Give a descriptive title of the invention:

The design of an IC Card interface system with application reload capability



- II. Give a brief statement explaining the essence of the invention and what benefit it provides. Use the space below (and on back, if necessary) for a sketch showing the important components of the invention.

The invention involves the design of a reloadable reader for use with IC Card. Among all the existing IC Card reader, it can be categorized into two groups. The first group is designed to work with a specified set of cards and has card application embedded into the masked ROM of the micro-controller in the reader. This group of reader cannot be modified to work with other IC Card once it has been built. The second group is designed to be a generic IC Card reader connected to a host. The card application is running in the host and the reader is merely served as an interface conduit. This group of reader does not offer any standalone application capabilities. The invention proposed in here is a new kind of reader, which captures the advantage from both groups of reader. The reader contains internal algorithm that can be updated with a secure download process. The internal algorithm enable the reader to be used in standalone mode and the reloadable capability allows the reader to be updated to support for new card or applications. The reader is also capable to be used in connected mode application. At this mode, the internal algorithm is disable, and the application is running at the host and using the resources in the reader.

background  
abstract

Internal design of the reloadable reader has two major blocks: Application Engine and an IO Engine. See attached block diagram for more details.

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SPYRUS INVENTION IDEA FORM

Docket No. (to be assigned by SPYRUS legal):

PA0887-01-4030

Name of person completing this form:

Gerry Vandenbergel

Date this form was completed:

[REDACTED]

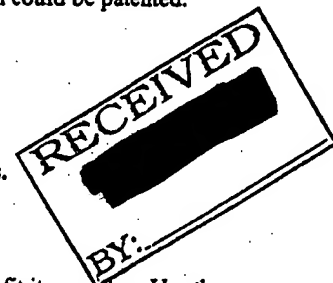
The purpose of this form is to provide a brief description of any ideas that you feel could lead to patentable inventions by SPYRUS. It should be filled out and filed with the Legal Office. Once completed, a determination will be made of whether to proceed with a full invention disclosure.

SPYRUS is committed to building a strong patent portfolio, both to protect our intellectual property rights and to strengthen our corporate position. Please document anything that you may be working on which you feel could be patented.

All of the following entries should be made in ink or type.

I. Give a descriptive title of the invention:

Method for communications for Portable Personal Smart Card Readers.



II. Give a brief statement explaining the essence of the invention and what benefit it provides. Use the space below (and on back, if necessary) for a sketch showing the important components of the invention.

Portable personal smart card readers are increasing in complexity and functionality while at the same time decreasing in cost. Economical design and reduced size are critical success factors for personal smart card readers. Two key features of personal smart card readers are:

1. Host or network communications capability. (the ability to connect a portable carry-along reader to a host computer so that it functions as a terminal).
2. Application reload capability, ie, the ability to allow the user to update or change the application programs for the reader.

This invention describes an innovative and compact method that combines both requirements. The Reader is implemented in 2 separate blocks, an I/O block and an Application Engine. Each block is implemented using a simple low cost micro-controller IC. (see block diagram). An asynchronous serial I/O channel provides connection to either a PC or other network host device through adapters. Internally this Serial I/O is connected to both the UART of the application engine and a serial port on the I/O block.

Lab  
i  
Summary  
(low cost)

The I/O block has at least 2 other ports: 1) A card interface port for communications with smart and 2) a Synchronous Serial Channel for communications with the application engine. In addition, the I/O block has ports for display output and keypad input. Additional smart card interface ports may be added as

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well.

In normal use, the reader is either functioning in stand-alone mode (no external connection to host) or connected mode. (connected to a host PC or network). In either case, the Application engine operates as BUS Master for the synchronous serial channel to the I/O block, and the asynchronous serial I/O port on the I/O block is inactive; ie, the application engine is the Master and the I/O block is the Slave. In connected mode, if the reader is connected to a PC, the application can send and receive commands to the PC host over this serial channel. (Typically RS-232 or Universal Serial Bus)

In addition to normal use, a user can also update the program in the Application engine by reprogramming flash memory or EEPROM in that I/C. A user would initiate programming mode by entering a key control sequence on the reader keypad. The I/O block then becomes the Master and the Application engine is the Slave. In addition, the I/O block opens the asynchronous Serial I/O channel to the host PC using the same physical connection used in connected mode operation.

The application program code is then downloaded from the host PC through this serial channel and re-written to the Application Engine non-volatile memory through the Synchronous Serial Channel. In this case, the I/O block provides reset and oscillator drive to the Application Engine. When the application program re-load is complete, power is cycled to the reader and normal operation resumes.

This invention provides the following benefits over existing portable personal smart card readers:

1. It provides program reload capability in a low cost and compact design by using one physical serial channel to connect to host computers or networks. This one serial channel can be used for both regular operation as well as reader application re-programming, thereby saving real estate and costs for additional connectors or cables.
2. This invention allows the smart card interface to be used as an option to download the new code from a smart card to the application engine with no additional circuitry or components, as the smart card interface is already built in for normal use.
3. This invention combines both normal I/O operating functions such as the display driver, keypad interface and smartcard interface with the re-programming function into one low cost micro-controller. This eliminates the need for additional components, and also allows the application engine to be simplified as much of the processing is done by the I/O engine. Normally, a larger application engine with the necessary EEPROM or flash memory would increase the overall cost of the reader.

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Fig. 3  
(on  
Fig. 6?)  
→ make  
since  
not  
duplication

Summary

- III. What were the methods or apparatus that were used but failed to solve the problem? Give source of previous information on the subject that is closest to your invention.

The author is not aware of any personal portable smart card readers that can be programmed both through a PC serial connection as well as through a smart card. Typically, in-circuit programmers would require a separate programming circuit or connection. Other designs may use separate or discrete program memory components which would increase the overall reader cost and size.

- IV. When did you first think of this invention?

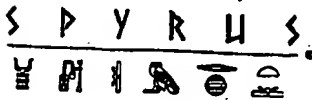
The idea was first conceived about [REDACTED] and reduced to practice in [REDACTED] as described in several internal specifications.

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SIGNATURE \_\_\_\_\_

DATE \_\_\_\_\_





**SPYRUS INVENTION IDEA FORM**

Docket No. (to be assigned by SPYRUS legal):

PH387-01-4027

Name of person completing this form:

Paul Chau

Date this form was completed:

[REDACTED]

The purpose of this form is to provide a brief description of any ideas that you feel could lead to patentable inventions by SPYRUS. It should be filled out and filed with the Legal Office. Once completed, a determination will be made of whether to proceed with a full invention disclosure.

SPYRUS is committed to building a strong patent portfolio, both to protect our intellectual property rights and to strengthen our corporate position. Please document anything that you may be working on which you feel could be patented.

All of the following entries should be made in ink or type.

- I. Give a descriptive title of the invention:

Secure applications download processes for electronic devices



- II. Give a brief statement explaining the essence of the invention and what benefit it provides. Use the space below (and on back, if necessary) for a sketch showing the important components of the invention.

As the application space for IC Card proliferating, many of the existing IC Card devices will be required to be compatible with the new application requirement. A new class of device having reloadability for its internal firmware started to emerge into the market. Since many of the new IC Card application involve financial and personal data exchange, it is crucial for such a reloadable device to be trusted and updated with legitimate application only. That in turns imposes a requirement for a secure procedure for application download. The secure application download process provides a way to authenticate both the device and the application sources before the device is updated with new application. It also protects the source data of the application by using a simple data encryption technique. The application source will be communicated with third party in an unprotected link, it is important to have temper resistance for the application source.

[REDACTED]

The process has support for combining a HEX file for a library application with the HEX file of the new application into one single HEX file.

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[Signature]

DATE

[REDACTED]

Details of the encryption technique have not been finalized yet at this point.

- III. What were the methods or apparatus that were used but failed to solve the problem? Give source of previous information on the subject that is closest to your invention.

Some of these concepts on the secure download might be described before for different kind of device or application areas. However, this is a solution for a new problem that becomes feasible when the new class of device is introduced. Also, using the IC Card as a download medium is a new idea as well.

- IV. When did you first think of this invention?

The idea of secure download has been discussed about 6 months ago when we start to conceptualize the design of the reloadable reader. At that point, we have only talked about using both the IC Card and the host as the interface for the application reload, we didn't have all the technique spelled out yet.

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SIGNATURE

DATE

**SPYRUS INVENTION DISCLOSURE**

The purpose of this form is to secure the disclosure and a record date of your invention. It should be filled out as thoroughly as possible and filed with the Legal Office. A separate form may be used for each invention or modification of the invention and each sheet should be signed and dated by the inventor(s) and also signed and dated by two witnesses, by whom the contents of the disclosure have been read and understood.

All of the following entries should be made in ink or type.

I. Give a descriptive title of the invention:

**The design of an IC Card interface system with application program reload capability.**

II. Give a clear and concise statement explaining the essence of the invention. Use the space below for a sketch showing the important components of the invention. If the space below is inadequate, attach separate drawings or prints and description (properly signed, witnesses and dated, if possible).

The invention involves the design of a reloadable interface device for use with IC Card. Among all the existing IC Card interface devices, they can be categorized into two groups in respect of their capabilities. The first group is designed to be a carry-along device. This group of devices has specified card application embedded into the masked ROM of the internal micro-controller, and is intended to support a specified set of IC cards. Once the device has been built, the internal application cannot be modified to support any new requirements or new cards. The second group is designed to be a generic IC Card interface device that connects to an external host. The card application is running in the host and the reader is merely served as an interface conduit. This group of reader does not offer any standalone application capabilities. The invention proposed in here is a new kind of smart card interface device that captures the advantage from both groups of interface device. The proposed smart card interface device contains internal application that can be updated with a secure download process. The internal application enables the interface device to be used in standalone mode and the reloadable capability allows the interface device to be updated to support new cards or applications. The interface device is designed to be used in connected mode. In connected mode, the internal application is disable, the application is running at the host and using the resources in the reader.

Internal design of the reloadable interface system consists of two major functional blocks: Application Engine and an IO Engine. See attached block diagram for more details.

The partitioning offers the following advantages:

1. Functional Partition: IO engine is responsible for all the low-level IC Card interfaces, IO functions and the secure download process. Application engine is the storage for the card application and also being used as the data filtering during connected mode operation.
2. Flexibility in processor choice for both the IO engine and Application engine, and an easy migration path to merge the functions of the two processors into one single processor for cost saving.
3. Provide identical command data protocol for both standalone and connected mode application development. An application developed in connected mode can also be used in standalone mode.
4. Provide multi-card support and multi-sources application reloading.
5. Program memory in the application engine can be partitioned out to provide support for multi-applications storage as well as incremental update capabilities for the device.

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Although the idea of reloading software into a device has been proposed many times, this invention is different because it is a new class of device and it offers different kind of operation environment for different kind of entity. Currently there is no other IC Card interface device has that kind of application reloadability. The reloadable reader is based on the design of the Value-Checker PLUS reader which is the first of its kind to have on-board keypad and LCD display for use in connected mode operation.

B. What are the problem(s) solved by the invention?

With the application reload capability, the proposed interface system solves the obsolesce problem that existed in most of the smart card interface devices. Many of the existing smart card interface device is custom designed to work with a specified set of cards to perform a specified application by loading into the Masked ROM of the micro-controller with the custom firmware. Once the device is built, it cannot be modified. Due to the fact that the smart card market is still in its infancy, the card specification and the application requirements are pronged to change at any time. When the specification of the card changed, the customized device will become obsolete. Even the cost of these custom devices is cheap enough to be a throwaway item, the cost to build a replacement device that works with the new specification is still very expensive. A typical cycle to produce a fixed firmware device is at least 12 weeks. And there is some substantial overhead cost involved in making the new device.

The memory space of the proposed device can be partitioned to store up multiple applications in a single unit. The same memory partitioning design also enables incremental upgrade for the interface device. This unique feature gives the customer the flexibility to deploy the device first before developing any specified application. And it also enables the customer to introduce new and upgrade applications to the device when they are in the field already. Since many of the smart card application deal with sensitive personal information, it is critical for the applications and the device to provide protection to such information. Because of security requirement, we need to ensure that only the legitimate applications can be loaded into an interface device. In the proposed device, the application download is implemented in a secure way to provide mutual authentication between the device and the incoming applications.

C. What were the methods or apparatus that were used but failed to solve the problem? Give source of previous information on the subject that is closest to your invention, such as known use, publication or patents.

As mentioned earlier, the proposed smart card interface system captures many of the advantages existed in some of the existing smart card devices. Most of the carry along device in the market is designed to have fixed firmware, and is designed to work a specified set of card and requirement in mind. This kind of device has simple input and output capabilities and is designed to extract simple information from the smart card and expose it to the user. The other kind of device is merely for use as a terminal for the smart card. They are attached to a host, and are served as an interface conduit between the application running in the host and the smart card. In general, this kind of device does not have any input and output capabilities as those carry alone devices. A new kind of device has been coming out to the market that combined the features of the carry along reader and host connected reader into a single entity. The first of its kind is the Value-Checker PLUS Smart Card Reader (it is now the Spyrus Personal Access Reader). The Spyrus Personal Access Reader is a compact size portable reader which can be customized with a specified card application, and is also a desktop reader which can connected to the host to provide an interface channel between the host and the card. Although the Personal Access Reader offers a lot of more features than most of the existing smart card reader/writer, it is a fixed firmware product, and it has the obsolesce problem.

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- D. State how present invention differs from previous methods or apparatus and what advantages it provides.

Personal Access Reader has the fixed firmware that can not be upgraded once it is built. The device proposed in here uses re-programmable memory to provide the firmware reload capability, thus enable the device to be upgraded even when it is already in the field.

- IV. What is the prospective value or utility of the invention for SPYRUS?

The current offering of the Personal Access reader is targeted as a connected mode smart card reader only. The next generation version, reloadable smart card reader, will be able to capture a bigger share of the smart card market. With its compact size, ease of use, applications reload capability and low cost, the proposed device will stand out among all the other existing readers. In addition, the secure download process and application development environment will further enhance the marketability of the device, and open up additional opportunity for Spyrus.

- V. Give the Project No. which covers the work done, if any, and identify any monthly or other issued reports. (Attachment of pertinent pages would be helpful.)

The project number for this development is RDSPYA-62-XXXX.

- VI. Have information, samples or technical bulletins relating to this invention been given to customer, have products relating to invention been sold, or has the process involved been used on a commercial scale? If the answer is yes, please give date and other details on an attached sheet.

The device is not yet for sale, it is still being developed. It is expected to be available in August of this year. The idea of the invention was originated from OKI, it has been disclosed to other companies under an NDA agreement in [REDACTED]

- VII. When did you first think of this invention?

The idea of reloadable reader was conceptualized about 15 months ago as intended for the next generation of the Value-Checker PLUS reader family. The actual design was carried out [REDACTED] and the first prototype was built and tested in [REDACTED]. There are several specifications have been written on the design of the reloadable reader.

- VIII. What records do you have to substantiate this conception date? (Notebook numbers and pages, letters, reports, etc.) What is the date of first written description and/or drawing?

We have some specification describing the architecture of the reloadable readers. These documents were originated from OKI.

- IX. Have you done any experimental work toward carrying out the invention? If so, when?

SIGNATURE(S) OF INVENTOR(S)	DATE	SIGNATURES OF TWO WITNESSES	DATE

The development is on-going right now. The concept has been proofed with demo hardware.

- X. When and how did you make the first disclosure of the invention to others either orally or in writing?

The idea of the invention was originated from OKI, it has been disclosed to other companies under an NDA agreement in [REDACTED]. The write up on the patent application was done in [REDACTED].

- XI. Give the date and description of past or future publications regarding or related to this invention.

No publications existed or planned for the inventions at this time.

- XII. Is further experimental work now under way or contemplated for the near future? If so, give a general summary of such work and some idea of when this phase of the program will be completed.

The development of the proposed device is on-going, and it is expected to be completed in August of 1999.

- XIII. Was this invention developed under a Government Contract? If yes, give the contract number.

No.

- XIV. Furnish the following information for each inventor. Please copy this page as necessary.

NAME IN FULL	Paul Wai-Hung Chau	NAME IN FULL	Kerry Matthews
TITLE		TITLE	
CITIZENSHIP	Hong Kong, CHINA	CITIZENSHIP	USA
HOME ADDRESS	26 TRAVIS ROAD	HOME ADDRESS	

SIGNATURE(S) OF INVENTOR(S)	DATE	SIGNATURES OF TWO WITNESSES	DATE

<b>CITY, COUNTY, STATE, and ZIP</b>	NATICK, MA USA 01760	<b>CITY, COUNTY, STATE, and ZIP</b>	
<b>SIGNATURE</b>		<b>SIGNATURE</b>	
<b>DATED</b>		<b>DATED</b>	
<b>SUPERVISOR'S NAME</b>		<b>SUPERVISOR'S NAME</b>	

<b>NAME IN FULL</b>		<b>NAME IN FULL</b>	
<b>TITLE</b>		<b>TITLE</b>	
<b>CITIZENSHIP</b>		<b>CITIZENSHIP</b>	
<b>HOME ADDRESS</b>		<b>HOME ADDRESS</b>	
<b>CITY, COUNTY, STATE, and ZIP</b>		<b>CITY, COUNTY, STATE, and ZIP</b>	
<b>SIGNATURE</b>		<b>SIGNATURE</b>	
<b>DATED</b>		<b>DATED</b>	
<b>SUPERVISOR'S NAME</b>		<b>SUPERVISOR'S NAME</b>	

REVIEWED BY:

SUPERVISOR NAME \_\_\_\_\_ DATED: \_\_\_\_\_

SIGNATURE \_\_\_\_\_

SIGNATURE(S) OF INVENTOR(S)	DATE	SIGNATURES OF TWO WITNESSES	DATE

## Exhibit C



SMARTREADER  
DEVELOPMENT BOARD  
APPLICATION ENGINE

AE ENGINE INTERRUPT TABLE

\_\_\_\_\_  
TBD

TBD

REVISION HIS TOP:

REV: - OUR RELEASED

NOTES:

1.) THIS IS A FLAT 5 CHANNEL.

SCHEMATIC TITLE NET ENTIONS:

AVE ENGINE  
PROCESSOR  
DEVELOPMENT BOARD  
POWER CONNECTIONS

ILINK  
AVE PROCESSOR 32K  
PROCESSOR 32K  
PROCESSOR 32K

TOP LEVEL

PROCESSOR

DEVELOPMENT BOARD

POWER CONNECTIONS

INSERT DRAWING HERE

SMARTREADER II DEVELOPMENT BOARD - BLOCK DIAGRAM

AE ENGINE

SYNOPSIS  
SMARTREADER II DEVELOPMENT BOARD  
SAN JOSE, CA 95134-1101

REVISION HIS TOP:  
REV: - OUR RELEASED  
REV: 0.1 FINAL NETLIST

BEFORE OUR

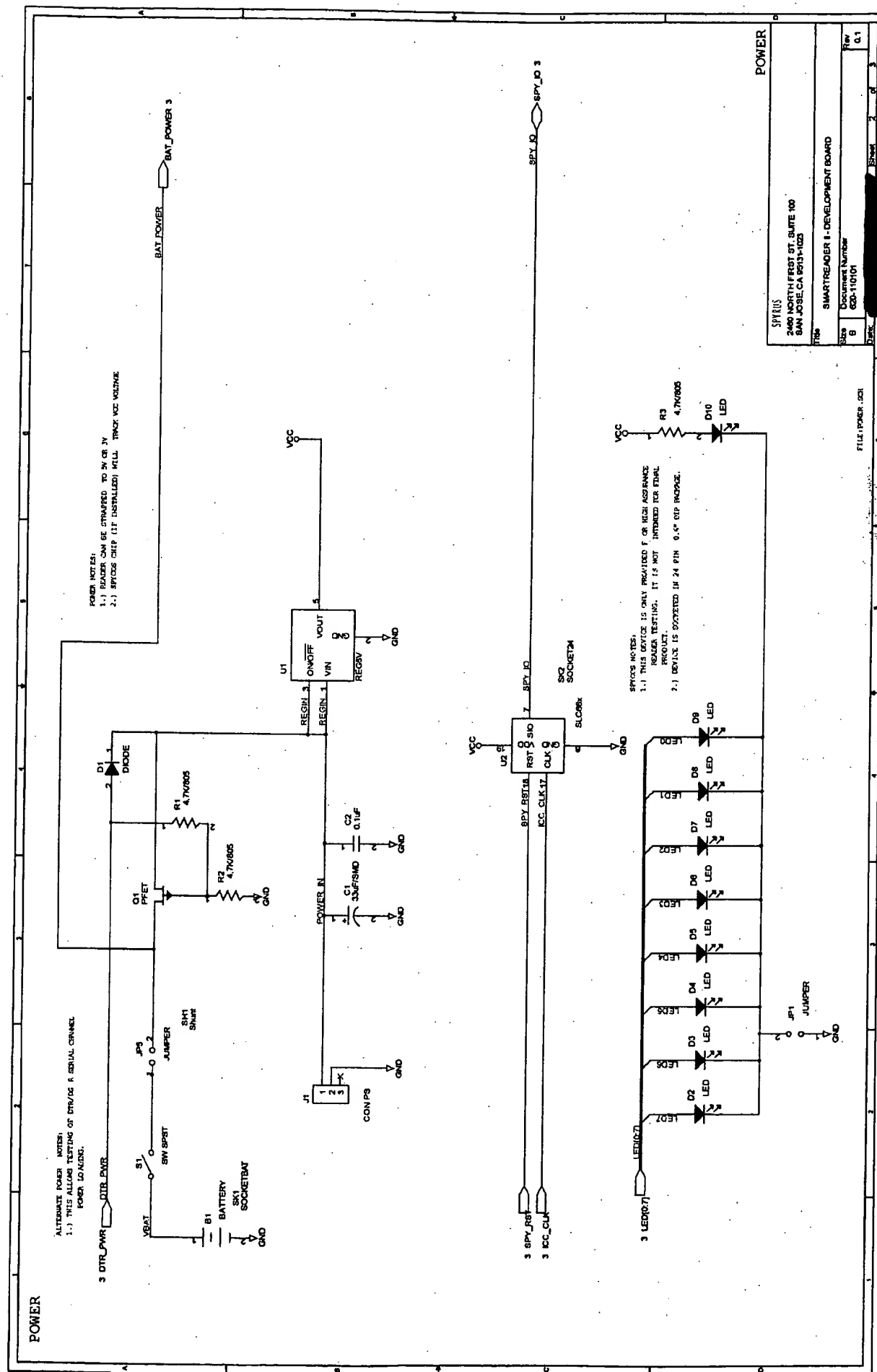
SMARTREADER II DEVELOPMENT BOARD

REV: 0.1

DWG NO  
620-110101

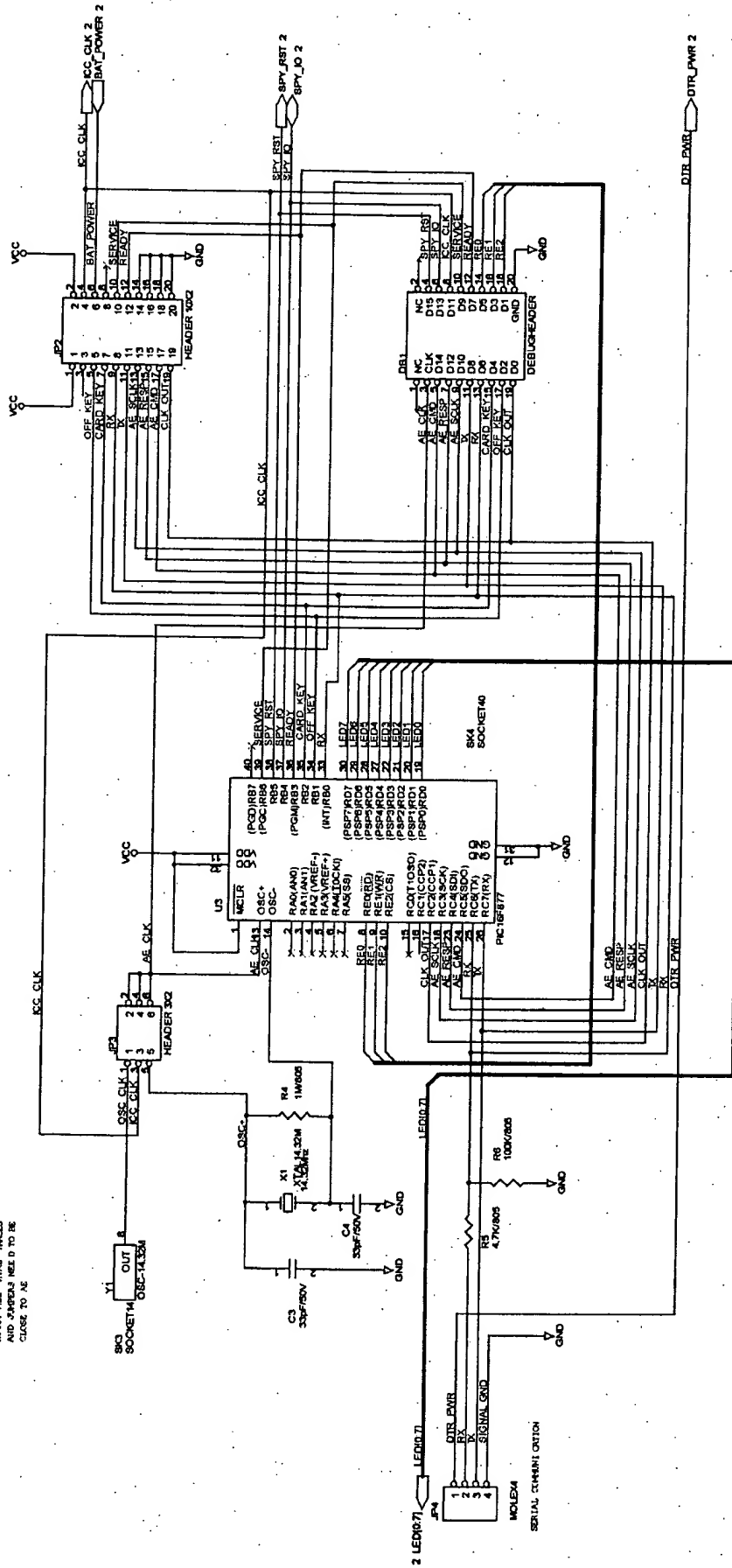
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# PROCESSOR

APPLICATION CLOCK OPTIONS:  
 1.) INDEPENDENT OSCILLATOR  
 2.) DIVIDED IEC CLK.  
 3.) XTAL/TERMINIC R ESORTER  
 4094: ALL XTAL TRACES  
 AND JAPPEAL WEL D TO BE  
 CLOSE TO AE



PROCESSOR	
SPRUS	
2400 NORTH FIRST ST. SUITE 100	
SAN JOSE, CA 95131-1023	
Title: SMARTREADER II DEVELOPMENT BOARD	
Size: B	Document Number: 620-110101
Rev: 0.1	Sheet: 3 of 3

FILE: PROC201.531

# SMARTREADER DEVELOPMENT BOARD IO ENGINE

## IO ENGINE INTERRUPT TABLE

TRD \_\_\_\_\_ TRD

### REVISION HISTORY

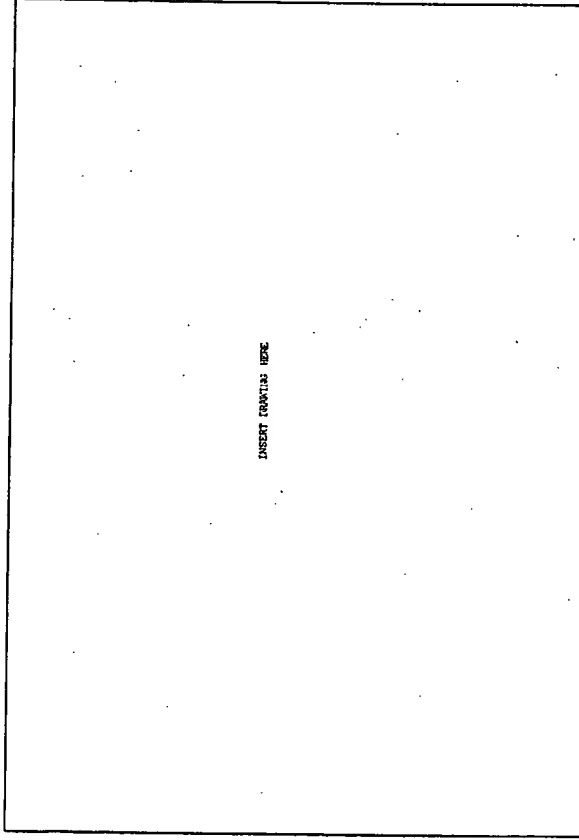
REV. - UNR ELASD  
REV 0.1 RELEASED TO CIO

### NOTES

1.1 THIS IS A PLAT 5 CHART.

SCHEMATIC TITLE REF DITIONS:  
IO ENGINE  
PROCESSOR  
IO ENGINE  
IO ENGINE  
IO ENGINE  
IO ENGINE

LINK  
IO ENGINE  
IO ENGINE  
IO ENGINE  
IO ENGINE



INSERT CHARTING HERE

## SMARTREADER II DEVELOPMENT - BLOCK DIAGRAM IO ENGINE BOARD

IO ENGINE

REVISION HISTORY:  
REV. - UNR ELASD  
REV 0.1 RELEASED TO CIO

SPRUS  
200 NORTH FIRST ST. SUITE 100  
SAN JOSE, CA 95131-1020

SMARTREADER II DEVELOPMENT  
IO ENGINE BOARD

REV. - UNR ELASD  
REV 0.1 RELEASED TO CIO

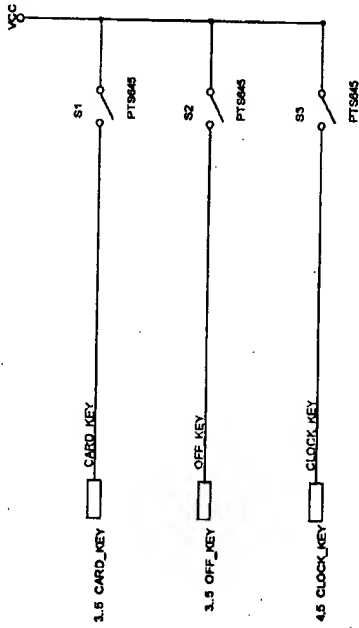
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FILE:IO\_TOP.CH

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Sheet 1 of 5

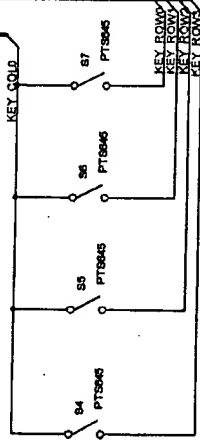
# KEYBOARD



HEADER BX1

HEADER BX2

HEADER BX1



KEY COL0 4

KEY ROW0 3

KEY COL0 4

KEY ROW0 3

KEY COL0 4

KEY ROW0 3

KEY COL0 4

KEY ROW0 3

KEY COL0 4

KEY ROW0 3

# KEYBOARD

SPRINTS	
2400 NORTH FIRST ST. SUITE 100	
SAN JOSE, CA 95131-1023	
Title	
IO ENGINE BOARD	
Size	
B	
Document Number	
625-110100	
Rev	
0.1	

FILE: KEYBOARD.D.X21

